CHEMISTRY

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

1. The correct increasing order of bond length among the following is

(1) $O_2^+, O_2, O_2^-, O_2^{2-}$

(2) $O_2^+, O_2, O_2^{2-}, O_2^-$

(3) $O_2^{2-}, O_2^-, O_2, O_2^+$

(4) $O_2^-, O_2^{2-}, O_2^+, O_2$

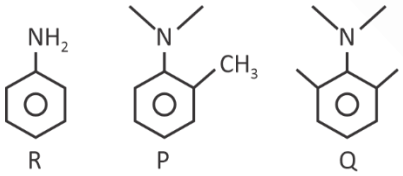
Answer (1)

Sol. More the bond order of molecule or ion less will be the bond length

$O_2^{2-} \Rightarrow BO = 1, O_2^- \Rightarrow BO = 1.5$

$O_2 \Rightarrow BO = 2, O_2^+ \Rightarrow BO = 2.5$

2. Write the correct order of rate of reaction of following with PhN_2Cl



(1) R > P > Q

(2) P > R > Q

(3) Q > P > R

(4) P > Q > R

Answer (1)

Sol. Due to S.I.R. Q and P are less reactive.

3. Match List-I with List-II

	List-I		List-II
(I)	Vitamin C	(A)	Thiamine
(II)	Vitamin B_1	(B)	Riboflavin
(III)	Vitamin B_6	(C)	Ascorbic Acid
(IV)	Vitamin B_2	(D)	Pyridoxine

(1) I-A, II-B, III-C, IV-D (2) I-C, II-A, III-D, IV-B

(3) I-A, II-C, III-B, IV-D (4) I-C, II-D, III-A, IV-B

Answer (2)

Sol. Vitamin C → Ascorbic Acid

Vitamin B_1 → Thiamine

Vitamin B_6 → Pyridoxine

Vitamin B_2 → Riboflavin

4. Arrange following functional group in the increasing order of priority of functional group:

$-CONH_2, -\overset{\overset{O}{\|}}{C}=O, -CHO, -CN, -C\equiv C-, -NH_2$

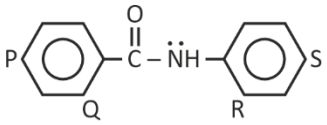
(1) 1 > 4 > 2 > 3 > 6 > 5 (2) 1 > 4 > 2 > 3 > 5 > 6

(3) 1 > 4 > 3 > 2 > 6 > 5 (4) 1 > 2 > 4 > 3 > 6 > 5

Answer (3)

Sol. Priority table.

5. In the given compound, the electrophile attack will be favoured at



(1) S (2) P

(3) Q (4) R

Answer (1)

Sol. Due to more electron density, E.A.S. will take place at position-S.

6. Which compound gives apple green colour in flame test?

(1) $BaSO_4$ (2) $Mn_3(PO_4)_2$

(3) $Ca_3(PO_4)_2$ (4) $Al_2(SO_4)_3$

Answer (1)

Sol. $Ba^{2+} \Rightarrow$ Apple green

$Ca^{2+} \Rightarrow$ Brick red

Mn^{2+} and Al^{3+} generally do not produce a distinct or characteristic colour to the flame in flame test.

7. One mole of alkane reacts with 8 mole of O_2. The molecular formula of alkane is

(1) C_4H_{10} (2) C_5H_{12}

(3) C_7H_{14} (4) C_3H_8

Answer (2)

Sol. $C_nH_{2n+2} + \frac{3n+1}{2}O_2 \rightarrow nCO_2 + (n+1)H_2O$

$\therefore \frac{3n+1}{2} = 8 \Rightarrow 3n = 15$

$\Rightarrow n = 5$

Alkane is C_5H_{12}

8. 18 g of H_2O reacts with x g of Fe to produce Fe_3O_4. 'x' is (Atomic mass of Fe = 56 u)

(1) 84 g (2) 63 g

(3) 42 g (4) 51 g

Answer (3)

Sol. $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

3×56 g 4 mol

$1\,mol\,H_2O \rightarrow \frac{3\times 56}{4} = 42$ g of Fe

9. The K_{sp} values of Ag_2CrO_4 and AgBr are 32x and 4y respectively. The ratio of solubilities $\frac{S_1}{S_2}$ is

[Here, S_1 is solubility of Ag_2CrO_4 and S_2 is solubility of AgBr]

(1) $\frac{2x^{1/3}}{y^{1/2}}$ (2) $\frac{x^{1/3}}{y^{1/2}}$

(3) $\frac{x^{1/3}}{2y^{1/2}}$ (4) $\frac{(2x)^{1/3}}{(2y)^{1/2}}$

Answer (2)

Sol. $Ag_2CrO_4 \rightleftharpoons \underset{2S_1}{2Ag^+} + \underset{S_1}{CrO_4^{2-}}$

$AgBr \rightleftharpoons \underset{S_2}{Ag^+} + \underset{S_2}{Br^-}$

$K_{sp}[Ag_2CrO_4] = [Ag^+]^2[CrO_4^{2-}]$

$32x = (2S_1)^2 \times (S_1)$

$8x = S_1^3$

$2x^{1/3} = S_1$ ...(i)

$K_{sp}(AgBr) = [Ag^+][Br^-]$

$4y = S_2 \times S_2$

$4y = S_2^2$

$2y^{1/2} = S_2$ ...(ii)

$\frac{S_1}{S_2} = \frac{x^{1/3}}{y^{1/2}}$

10. The orbit angular momentum of e in n^{th} shell of H atom is $\frac{3h}{\pi}$. The total energy of e is

(1) –0.38 eV (2) –3.4 eV

(3) –0.544 eV (4) –0.85 eV

Answer (1)

Sol. Orbit angular momentum (mvr) $\Rightarrow \frac{h}{2\pi} \times n = \frac{3h}{\pi}$, So n = 6

Total energy of e = $-13.6 \times \frac{z^2}{n^2}$ eV

$= -13.6 \times \frac{1^2}{6^2} = -0.38$ eV

11. Arrange the following complexes in the increasing order of crystal field splitting energy (Δ_0)

(a) $[Cr(CN)_6]^{3-}$ (b) $[CrF_6]^{3-}$

(c) $[Cr(NH_3)_6]^{3+}$ (d) $[Cr(en)_3]^{3+}$

(1) (b) < (c) < (d) < (a) (2) (a) < (b) < (c) < (d)

(3) (a) < (d) < (c) < (b) (4) (b) < (a) < (c) < (d)

Answer (1)

Sol. More the strength of ligand, more will be splitting energy.

Ligand strength order $F^- < NH_3 < en < CN^-$

So order of $\Delta_0 \Rightarrow$ (a) > (d) > (c) > (b)

12. Calculate the energy required for the following process

$Li^{2+} \rightarrow Li^{3+} + e^-$

Given: Ground state energy of Hydrogen is –13.6 eV/atom

(1) 13.6 eV/atom (2) 122.4 eV/atom

(3) 54.4 eV/atom (4) 30.6 eV/atom

Answer (2)

Sol. The energy required for ionisation of

Li^{2+} ion = $+13.6\ z^2$

$= 13.6 \times 3^2$

$= 122.4$ eV/atom

13. 20 g fluoroacetic acid is dissolved in 500 gm water. If depression in freezing point is 1°C, then calculate K_a for fluoroacetic acid. [Assume molality is same as molarity]

(1) 1.18×10^{-3} (2) 1.5×10^{-5}

(3) 1.18×10^{-4} (4) 1.2×10^{-6}

Answer (1)

Sol. $\Delta T_f = i \times K_f \times m$

$$1 = (1+\alpha) \times 1.86 \times \frac{20 \times 1000}{78 \times 500}$$

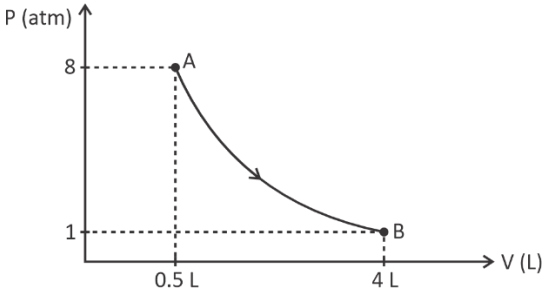
$$1 + \alpha = \frac{1}{0.954} = 1.048$$

$\alpha = 0.048$

4.8%

$$K_a = \alpha^2 c = (0.048)^2 \times \frac{20 \times 1000}{78 \times 500} = 1.18 \times 10^{-3}$$

14. Calculate work in following process during A to B, in following graph. (Given $C_V = 3R$)



(1) –6.2 L.atm (2) –8.3 L.atm

(3) –4.8 L.atm (4) –9.2 L.atm

Answer (2)

Sol. $W_{Rev} = -2.303 \times (P_f \cdot V_f) \times \log \frac{V_f}{V_i}$

$$= -2.303 \times (4 \times 1) \times \log \frac{4}{0.5}$$

$= -2.303 \times 4 \times 0.9$

$= -8.3$ L.atm

15. Match **List-I** with **List-II**

	List-I (Molecules)		**List-II (Test)**
(I)	Ethanol	(P)	Neutral $FeCl_3$
(II)	Phenol	(Q)	Cerric ammonium nitrate
(III)	Ethanoic Acid	(R)	Schiff reagent
(IV)	Acetaldehyde	(S)	$NaHCO_3$

(1) I-P, II-Q, III-R, IV-S (2) 1-Q, II-S, III-P, IV-R

(3) I-Q, II-P, III-S, IV-S (4) 1-P, II-Q, III-S, IV-R

Answer (3)

Sol. Ethanol → Cerric ammonium nitrate

Phenol → Neutral $FeCl_3$

Ethanoic Acid → $NaHCO_3$

Acetaldehyde → Schiff reagent

16. Which of the following relation about first order and zero order reaction is correct

(1) $\left(t_{1/2}\right)_{\text{first order}} = 2\left(t_{100\%}\right)_{\text{first order}}$

(2) $\left(t_{100\%}\right)_{\text{first order}} = \text{Infinite time of } t_{1/2} \text{ of first order}$

(3) $\left(t_{1/2}\right)_{\text{zero order}} = 2 \times \left(t_{100\%}\right)_{\text{zero order}}$

(4) $\left(t_{100\%}\right)_{\text{zero order}} = \text{inf inite time of } t_{1/2} \text{ of zero order}$

Answer (2)

Sol. For zero order

$[A_t]_0 = [A_0] - kt$

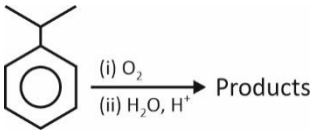
$t_{1/2} = \frac{[A_0]}{2k}$ $\quad t_{100\%} = \frac{[A_0]}{k}$

For first order

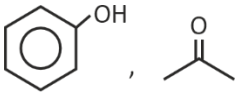
$t_{1/2} = \frac{0.693}{k}$

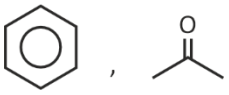
First order reaction never goes to completion.

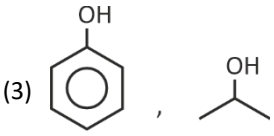
17. Consider the following reaction :



Products obtained are

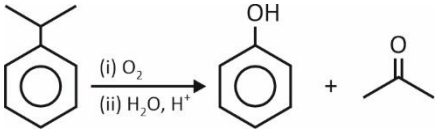
(1) 

(2) 

(3) 

(4) 

Answer (1)

Sol. 

18. Given below are two statements.

Statement I : First I.E. order : Na > Mg > Al.

Statement II : 3rd I.E. order : Mg > Al > Na.

(1) Both Statement I and Statement II are incorrect

(2) Statement I is correct but Statement II is incorrect

(3) Statement I is incorrect but Statement II is correct

(4) Both Statement I and Statement II are correct

Answer (1)

Sol. IE_1 (KJ/mol)

Na 496

Mg 737

Al 577

For third IE, electronic configuration drives the order.

$Mg^{2+} \xrightarrow{-1e^-} Mg^{3+}$

2, 8 2, 7

$Al^{2+} \longrightarrow Al^{3+}$

2, 8, 1 2, 8

$Na^{2+} \longrightarrow Na^{3+}$

2, 7 2, 6

19.

20.

SECTION - B

Numerical Value Type Questions: This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. For first order reaction rate constant at 27°C and t°C is 1.5×10^3 and 4.5×10^3 respectively. If the activation energy of reaction is 60 kJ, then find temperature t.

($R = 8.3\ Jmol^{-1}\ K^{-1}$)

Answer (41)

Sol. $\log\frac{k_1}{k_1} = \frac{E_a}{2.303R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

$\log\frac{4.5}{1.5} = \frac{E_a}{2.303R}\left(\frac{1}{300} - \frac{1}{T}\right)$

$\log 3 = \frac{60000}{2.303 \times 8.3}\left(\frac{(T-300)}{300T}\right)$

$\frac{0.48 \times 2.303 \times 8.3}{60000} = \frac{T-300}{300T}$

$0.0001529 \times 300T = T - 300$

On solving,

$T = \frac{300}{0.95413}$

$T = 314.4\ K$

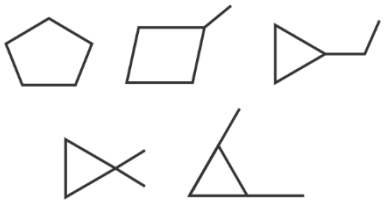
$= 41.4°C$

$\approx 41°C$

22. Calculate number of isomers of C_5H_{10}, which does not decolorise cold alkaline $KMnO_4$ solution.

Answer (7)

Sol. Cycloalkanes do not react with cold $\bar{O}H$ /$KMnO_4$, while alkenes do react.



(d + l + meso)

Total isomers = 1 + 1 + 1 + 1 + 3 = 7

23. 8 g of $[CrCl_x(H_2O)_y]Cl_{(3-x)} \cdot H_2O_{(6-y)}$ react with average $AgNO_3$ to form 8.61 g of AgCl. The value of (x × y) is _____.

Answer (5)

Sol. mol of $CrCl_3 \cdot 6H_2O = \frac{8}{266.5} = 0.03$

mol of AgCl formed = $\frac{8.61}{143.5} = 0.06$

0.03 mol of compound forms 0.06 mol AgCl

So, 1 mol of compound forms = $\frac{0.06}{0.03}$ = 2 mol AgCl

So formula is $[CrCl(H_2O)_5]Cl_2 \cdot H_2O$

3 – x = 2, x = 1

6–y = 1, y = 5

x × y = 1 × 5 = 5

24.

25.